UNIT ONE:
Chemical Substances

For the First Prep Grade

Lesson One: Metals and Non-metals

Comparison Point

Comparison Point	Metals	Non-metals
Outer Energy Level	Ends with 1, 2, or 3 electrons	Ends with 5, 6, or 7 electrons (except H and C)
Physical State	Solid (except mercury is liquid)	Solid and gaseous (except bromine is liquid)
Electrical Conductivity	Good conductors	Poor (except graphite carbon is good)
Other Properties	Have luster, are malleable and ductile	Have no luster, are brittle (not malleable)

Metallic Bonding and Alloys

Metallic Bond: Force of attraction between positive metal ions and the surrounding cloud of negative valence electrons.

The Golden Rule:
The more the number of valence electrons, the stronger the bond force, the greater the hardness and melting point.

(Example: Aluminum Al (3 electrons) stronger than Magnesium Mg (2) stronger than Sodium Na (1)).

Alloy: A mixture made of molten form of two or more metals.
(Like: Bronze = 95% Copper + 5% Tin).

Recycling: Converting waste to new materials (important for metals due to lower cost and difficulty of extracting them from nature).

Lesson Two: Acads and Bases

	Alkalis	Acids
Properties	✓ Substances that when dissolved produce negative hydroxide ions (-OH) ✗ Do not produce hydrogen	✓ Substances that when dissolved produce positive hydrogen ions (+H) ✗ Do not produce hydroxide
Definition	Turn litmus paper blue	Turn litmus paper red
Litmus	Turn red litmus paper blue	Turn blue litmus paper red
Examples	Sodium hydroxide, milk of magnesia (treats acidity).	Sulfuric acid, lactic acid (causes muscle cramps).

Continued Lesson Two:

Oxides (union of element with oxygen):

Basic oxide

Acidic oxide

Text with acid rain with SO_2

Acid rain Type

SO_2, H_2SO_3

Lesson: Chemical Indicators and Salts

Chemical Indicators and the pH scale (pH)

Indicators: Chemical substances whose color changes in an acidic medium from its color in an alkali medium (e.g., litmus).

The pH scale (from 0 to 14):

0 1 2 3 4 5 6 7 8 9 10 11 12 12 13 14

- Less than 7 → Acidic (the closer to 0, the stronger the acid).
- Equal to 7 → Neutral (e.g., distilled water).
- Greater than 7 → Alkaline (the closer to 14, the stronger the alkali).

Success Tip:
Hydrangeas flowers change color according to soil type, so soil acidified with Calcium Hydroxide.

Salts

✓ Vary in Color:

White salts ($NaCl$, $2nSO_4$)

Colored salts (Blue Copper Sulfate, Green Nickel Chloride)

✓ Vary in Water Solubility:

✓ Soluble: (All Sodium, Potassium, Ammonium, and Nitrate salts).

✗ Insoluble (Slightly Soluble): (Silver Chloride $AgCl$) and all Carbonate salts except Sodium/Potassium/Ammonium Carbonates).

Atomic Groups (Radicals)

An ion composed of more than one atom of more than one element, behaving as a single atom and having its own special valence.

Positively Charged:

Ammonium group ($+NH_4$).

- $-OH$ → Hydroxide ($-OH$)
- $-NO_3$ → Nitrate ($-NO_3$)
- $-CO_3$ → Carbonate ($^{2-}CO_3$)
- $-SO_4$ → Sulfate ($^{2-}SO_4$)

Success Tip:

Always remember that the gas that removes the color of a wet litmus paper strip is...

Chlorine Gas,

While Ammonia Gas turns it blue!!

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UNIT TWO (ENERGY AND ITS APPLICATIONS)

LESSON ONE: DISTANCE, DISPLACEMENT AND SPEED

MOTION PATH: DISTANCE VS. DISPLACEMENT

COMPARISON POINT	DISTANCE (d)	DISPLACEMENT (s)
Definition	The actual length of the path taken by the body from the starting point to the end.	The shortest straight-line path connecting the starting point and end point in a fixed direction.
Value	Its value varies with different motion paths.	Its value remains constant, unchanged by path variation.
Unit of Measurement	Meter (m) or Kilometer (km)	Meter (m) or Kilometer (km)

IMPORTANT NOTE: Distance equals displacement *only* if the body moves in a straight line and fixed direction!

SPEED (v)

Speed: The distance covered per unit of time.

Law:

Speed = Distance ÷ Time

$$v = \frac{d}{t}$$

Relationships:

- Speed ↑ increases with increasing distance covered (directly proportional relationship).
- Speed ↑ increases as the time taken decreases (inversely proportional relationship).
- The product (Speed × Time) = Distance.

LESSON TWO: POTENTIAL ENERGY AND KINETIC ENERGY

WORK (W):

The amount of energy needed to move an object (or body).

(Work = Force × Displacement).

(!) No work is done if the object does not move!

MECHANICAL ENERGY (ME):

Mechanical Energy: The sum of potential and kinetic energies of any moving object.

ME = PE + KE

And it is always a constant value.

ENERGY COMPARISON: POTENTIAL VS. KINETIC

Characteristics	Potential Energy (PE)	Kinetic Energy (KE)
Definition	Energy stored in the body due to work done on it.	The energy an object gains as a result of its motion.
Affecting Factors	Weight (w) and Height (h)	Mass (m) and Speed (v)
Law	PE = w × h	$KE = \frac{1}{2} m \times v^2$
Unit of Measurement	Joule (J)	Joule (J)

Problem-Solving Tip: Remember that (Weight = Mass x Acceleration of Gravity).

WHERE DOES ENERGY GO DURING FREE FALL OR PENDULUM MOTION?

1 At maximum height

Speed of body = zero
Kinetic energy = zero
Potential energy = maximum (equals mechanical energy)

2 At vertical mid-distance

Potential energy = Kinetic energy.
(Mechanical Energy = twice Potential Energy = twice Kinetic Energy)

3 Moment of Ground Impact (or lowest point)

Height = zero
Potential energy = zero
Kinetic energy = maximum (equals mechanical energy)

EXAM SECRETS (WHAT HAPPENS IF...):

1 What happens when a body's speed doubles?

Its kinetic energy increases four times!
(Because speed is squared v^2 in the formula).

2 What happens to the object's mechanical energy during its fall?

It remains constant.
(Because the decrease in potential energy is offset by an equal increase in kinetic energy)

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SCIENCE - FIRST PREP GRADE

LESSON ONE: FOOD RELATIONSHIPS IN BIOTIC COMMUNITIES AND ENERGY FLOW

1 Levels of the Ecosystem

Ecosystems consist of living (biotic) and non-living (abiotic) components, progressing through levels of organizatien as follows:

- **Individual:** A single living organism belonging to a specific species.

- **Biotic Population:** A group of individuals of the same species living in the same time and place.

- **Biotic Community:** Different biotic populations living together in the same environment.

- The interaction of the biotic community with the abiotic components.

2 Patterns of Food Relationships

Commensalism

One organism benefits, while the host is neither helped nor harmed.

e.g., Plover bird and Niile crocodile

Mutualism

A relationship in which both organisms benefit.

e.g., Root nodule bacteria and bean plants

Competition

A struggle between individuals of the same species for a limited resource, and both are harmed.

e.g., Two lions competing for food

Predation

An interaction in which the predator benefits and the prey is harmed.

e.g., Lion and zebra, or Dionaea plant and insects

3 Classification of Organisms within the Biotic Community

Producers

Produce their own food (e.g., plants and algae).

Consumers

Rely on producers, divided into:

- Herbivore: Eats plants (e.g., rabbit)

- Carnivore: Eats meat (e.g., lion)

- Omnivore: Eats plants and meat (e.g., bear)

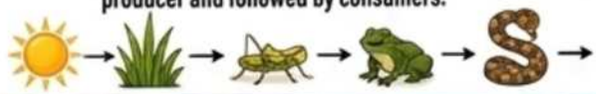
- Scavenger: Feeds on carcasses (e.g., hyena).

Decomposers

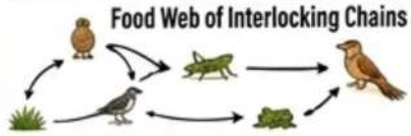
Break down the bodies of dead organisms (like bacteria and fungl) and recycle nuti-rients into the soil.

4 Energy Flow

The path of energy transfer from one organism to another, always starting with a producer and followed by consumers.



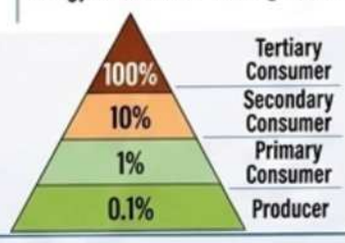
Food Web of Interlocking Chains



Energy Pyramid

An energy pyramid shows available energy decreases at each higher level.

Energy plarnd. cxplaining that only 10% of energy energy is transferred to the next trophic level, while 90% is lost.



LESSON TWO: INHERITED TRAITS AND MUTATIONS

Biological Control

Pest control by natural organisms eliminates pests (e.g., using ladybugs to eliminate aphids on plants).

1 Types of Traits and Behaviors

Instinctive Behaviors

Transferred without learning (e.g., bat sleeping upside down, spider weaving a web).

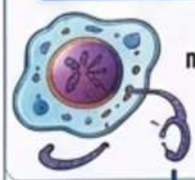
Acquired Traits

Gained from the environment through learning and are net inherited languages, riding a bike).

Inherited Traits

Transferred from parents to offspring without learning (e.g., eye coler, hair color).

2 Genetic Material (Chromosomes)



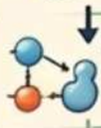
Located in the nucleus (eukaryotes) or cytoplasm (prokaryotes).

Chemically composed of nucleic acid (DNA) wrapped around proteins called (histones).

DNA is composed of genes, and the gene is composed of smaller units called nucleotides.

3 Mechanism of Gene Action (Beadle & Tatum Hypothesis)

Each gene produces an enzyme



Enzyme causes a chemical reaction

The reaction forms a protein

The protein manifests the inherited trait

4 Mutations

Appearance of a new inherited trait due to a change in the gene nature or nuclectide sequence.

By Effect

Harmful

e.g., Muscie atrephy and spinal deformity.

Beneficial

e.g., Lactose tolerance, or producing rust-resistant wheat.

By Origin

Induced

With human intervention (e.g., producing featherless chickens).

Spontaneous (Natural):

Occors without human intervention (e.g., albinism mutation).

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UNIT FOUR: NATURE'S CYCLES

LESSON 1: THE WATER CYCLE IN NATURE

IMPORTANT STATISTICS

71% of this force of Earth's surface

97% 97% Saltwater Saltwater, 3% Freshwater Must Conserve!

70% of Human Body of Human Body

PROCESSES OF THE WATER CYCLE

PROCESS	DESCRIPTION & STATE CHANGE
Evaporation	Process of changing from a liquid state (water) into a gaseous state (vapor), gaining heat.
Condensation	Process of changing from a gaseous state (vapor) into a liquid state (water), releasing heat and forming clouds.
Precipitation	Process of condensed water vaper falling from clouds as rain, snow, or hail.
Surface Runoff	Process ef excess water flcwing over the Earth's surface into streams, rivers, and oceans.
Transpiration	Process of water vapor loss from the leaves and stems of plants to the atmosphere.
Infiltration	Process by which water on the ground surface enters the soil and feeds groundwater.

1. WEATHERING

(BREAKDOWN/SPLITTING OF ROCKS)

CHEMICAL WEATHERING
- Acid rain (otoilslowly consiterations and increased (uses near ases)

MECHANICAL/PHYSICAL WEATHERING
- Ice wedging (formed snow pool -handnd of reaids in the air effects (merids)

2. EROSION AND DEPOSITION

Description and deposition are sheets as A DUAL-EDGED SWORD

BENEFICIAL Forms soil

HARMFUL Coastal erosion

FOSSIL FUELS (Stored Solar Energy)

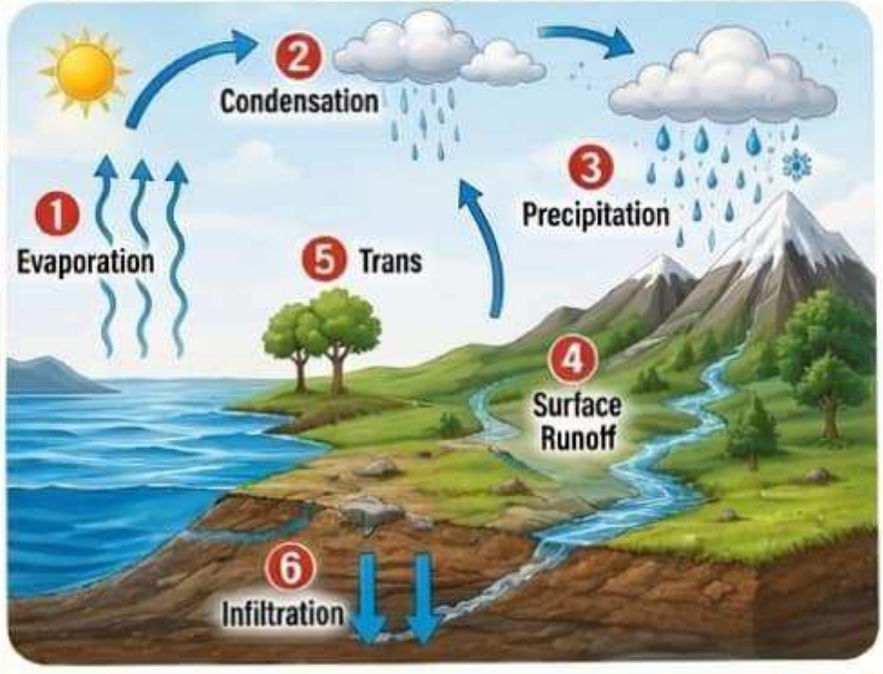
Coal
From massive plant material buried millions of years ago, formed by heat and pressure.

Oil & Natural Gas
Source: Small marine organisms, plankton, and algae. 90% of natural gas is methane.

DRIVING FORCES OF NATURE'S WATER CYCLE

SUN'S HEAT
Creates the primary energy force: (Earth on ocean (heat) (light))

EARTH'S GRAVITY
Gravity drives precipitation, surface flow, and infiltration to move water across and into the ground



LESSON 2: THE ROCK CYCLE & GEOLOGICAL PROCESSES

CLASSIFICATION OF ROCKS

ROCK TYPE	CHARACTERISTICS	EXAMPLES FROM NATORE
Igneous Rocks	• Cools slowly	Intrusive [Granite & Gabbro]
Igneous Rocks	• Cools quickly	Extrusive [Basalt & Pumice]
Sedimentary Rocks	• Formed in layers, • Clastic, can contain fossils	Limestone Sandstone Shale
Metamorphic Rocks	• From existing rocks under high pressure and heat	Marble from Limestone Quartzite from Sandstone

EXAM SECRETS

Q: Why is magma considered the 'rock that melts the most' in the Earth's interior?

A: Because it's the molten version of rocks. What else can it melt? It can form different rock types depending on how it cools.

Roots and vegetation: The roots of many plants penetrate the subsoil to absorb water, which can contribute to breaking down rocks through hydraulic action. (The soil holds and releases it through infiltration, leading to water tables and groundwater flow).

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